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DISJUNCT POPULATIONS OF THE ALLEGED SERPENTINE ENDEMIC, *ASTER DEPAUPERATUS* (PORTER) FERN., ON DIABASE GLADES IN NORTH CAROLINA

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ABSTRACT

A disjunctive range extension of the rare *Aster depauperatus* (Porter) Fern. is reported for the first time from several diabase glades in north central North Carolina. The species was previously known only from serpentine soils and the North Carolina populations hence represent an extension in both range and habitat.

Key Words: *Aster depauperatus,* diabase, serpentine, Granville Co., N. Carolina

The unusual properties of serpentine, notably a low calcium-to-magnesium ratio and relatively high concentrations of heavy metals, are linked with edaphic endemics wherever large bodies of serpentine occur (Brooks, 1987). The largest bodies of serpentine in the eastern United States form a narrow belt in the piedmont of Maryland and eastern Pennsylvania; these areas support a few endemic taxa (Reed, 1986; Brooks, 1987). Other serpentine outcrops occur in western North Carolina where the floristics and vegetation have been investigated by Radford (1948) and Mansburg and Wentworth (1984). These western North Carolina areas support a few disjuncts from the midwestern prairie regions, some of which also occur in Maryland and Pennsylvania, but none of the eastern United States endemics has been previously reported from these montane sites.

This note reports the occurrence of *Aster depauperatus* (Porter) Fern., one of the eastern North America serpentine endemics, from three diabase glades in Granville County in north central North Carolina. The previously known distribution of *A. depauperatus* coincides with that of serpentine barrens in Maryland, Pennsylvania (Wherry et al., 1979), and West Virginia (Reed, 1986). Reed (1986), however, cited a specimen from Nelson County, Virginia but *A. depauperatus* is not included in the recent *Atlas of Virginia Plants* (Harvill et al., 1986). Two of the newly

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discovered populations reported here are located within 1 km of each other and the third (at a locality described by LeGrand, 1988) is approximately 5 km distant from the first two. However, these sites are all part of one massive diabase intrusion (North Carolina Department of Natural Resources and Community Development, 1985). At all three sites *A. depauperatus* is a very common and conspicuous member of the fall flora with populations of well over 100 plants at each locality.

The vegetation of the diabase glades occurs on a substrate of Iredell soil which can be recognized by small surficial iron concretions to 1 cm diameter and a subsurface clay hardpan (Batson, 1952, Ph.D. thesis, Duke University, Durham, NC). The circumneutral pH of these sites contrasts with the surrounding acidic soils bordering the diabase intrusion. Floristically, the diabase glades harbor a mixture of species from habitats of high endemism in the eastern United States; representatives from granitic outcrops include *Portulaca smallii* P. Wilson, *Crotonopsis elliptica* Willd., and *Cyperus granitophilus* McVaugh (McVaugh, 1943); species most often associated with limestone cedar glades in Tennessee and Missouri include *Isanthus brachiatus* (L.) BSP., *Scutellaria parvula* Michx., *Berberis canadensis* P. Mill., *Silphium terebinthinaceum* Jacq., and the rhizomatous *Parthenium hispidum* Raf. (Steyermark, 1963). Moreover, in addition to *Aster depauperatus,* these glades also support *Polygonum tenue* Michx., a characteristic member of serpentine barrens (Wherry, 1963; Reed, 1986). Other species, of note because of their sporadic occurrence in piedmont North Carolina, include *Solidago rigida* L., *Eupatorium altissimum* L. (= *Ageratina altissimum* (L.) Spach), *Lotus helleri* Britt., and *Paronychia fastigata* (Raf.) Fern.

Our identification of the *Aster* was based upon morphological comparisons of the North Carolina plants with herbarium specimens (DUKE, PA, PH) as well as with measurements given in Hart (1980) and Fernald (1970). Several plants from each locality were transplanted and grown in the greenhouse to determine if the characteristic morphology is retained under less restrictive conditions. Chromosome counts were conducted to confirm the morphological determinations.

In *Aster depauperatus* the basal and lower cauline leaves are lost prior to anthesis, and new basal leaves emerge near the end of the flowering season. Because most herbarium specimens are of flowering material, there are either no basal leaves or they are

Table 1. Comparison of morphological characters of *Aster depauperatus* between Maryland and Pennsylvania serpentine barrens and North Carolina diabase glades. For Maryland–Pennsylvania plants, number of disk florets is from Fernald (1950) and basal leaf measurements are from Hart (1980); for North Carolina plants, basal leaf measurements are from greenhouse-grown plants; all other values are from herbarium specimens. All values are in cm $\bar{x}$ = mean, SD = standard deviation.

		Character						
		No. Disk Florets	Capitula		Basal Leaf		Cauline Leaf	
			Length	Width	Length	Width	Length	Width
Serpentine (MD–PA):	$\bar{x}$	6–12	0.43	0.44	6.10	0.59	2.82	0.14
	SD	—	0.04	0.05	0.80	0.05	0.78	0.05
Diabase (NC):	$\bar{x}$	8.30	0.41	0.41	4.26	0.73	2.20	0.12
	SD	1.60	0.03	0.06	0.79	0.07	1.21	0.04

immature. For these reasons we compared basal leaf measurements of our greenhouse-grown plants to those of common garden plants of *A. depauperatus* cited in Hart (1980).

The North Carolina plants were indistinguishable from *Aster depauperatus* on the basis of basal and cauline leaf widths, capitula sizes, involucral features of bract shape and texture, the number of disk florets per head, and the deciduous nature of basal and lower cauline leaves (Table 1). These distinctive traits were retained in greenhouse-grown plants and therefore we conclude that the North Carolina populations represent a disjunct series of populations of *A. depauperatus* where the plants inhabit a newly-recorded substrate for the species.

Chromosome numbers in four plants were counted to confirm our initial morphological determination. Mitotic chromosomes in root tips of plants that had been transplanted into the greenhouse were stained with aceto-carmine. The diploid chromosome number in all four plants was $2n = 16$. Two previous reports of the chromosome number in *Aster depauperatus,* both on plants from the serpentine barrens in Pennsylvania, also found $2n = 16$ (Morton, 1981; Semple and Chmielewski, 1985). In *A. pilosus,* chromosome numbers throughout the range of the species were between $2n = 32$ and $2n = 48$ (one count of $2n = 56$) (Semple and Chmielewski, 1985). Thus, cytologically in addition to morphologically, the plants in Granville County are similar to those on serpentine barrens to the north.

Curiously, there are some outcroppings of serpentine in adjacent Wake County, North Carolina (Dickey, 1963, M.S. thesis, North Carolina State University, Raleigh, NC) but at these sites neither *Aster depauperatus* nor any of the above-mentioned associated species was seen. These small serpentine intrusions do support a stunted open canopy, however, dominated by *Pinus echinata* P. Mill. and *Quercus marilandica* Muenchh. with *Andropogon scoparius* Michx. and *Stipa avenacea* L. in the understory. Furthermore, *Aster depauperatus* was not found on similar diabase sites in neighboring Durham County or even in nearby sites in Granville County; it is seemingly restricted to only a few localized populations.

North Carolina Specimens Examined. Granville Co.: Butner diabase glade, E side of Route 1100 about 1.5 mi. N of railroad tracks crossing 1100, *Levy s.n.* 8 X 1987 (DUKE); 1.5 mi. S of Butner Route 1103 on 1209, *Levy s.n.* 15 VIII 1988 (DUKE); on Iredell soil about 1 mi. W of Butner along Interstate 85, *Levy s.n.* 7 IX 1988 (DUKE); diabasic heavy clay soils about 2.5 mi. SE of Butner on County Rd. 1209 paralleling U.S. Interstate 85, *Wilbur 44700 A, 44703* (DUKE); diabasic soils about 2 mi. SE of Butner on State Rd. 1209 paralleling Interstate 85, *Wilbur 44676* (DUKE); *RLW 51709* (DUKE, GA, GH, NCU, NY, PA, PH, US, USCH); heavy clay soils about 2 mi. E of Butner on State Rd. 1209 paralleling Interstate 85 about 1 mi. from its intersection with SR 1103 at site being rapidly destroyed by off-road vehicles, *Wilbur 51690* (DUKE); forest glade 2 mi. N of Butner on State Rd. 1100 on diabasic soil, *Wilbur 51674, 51675* (DUKE).

Although the occurrence of *Aster depauperatus* in the diabase glades is of biogeographic interest, it is not wholly anomalous. Iredell soils in Granville County possess a higher pH relative to adjacent soil types (6.4 versus 5.0 respectively) (Dayton, 1966). Possibly of greater importance to the establishment and persistence of serpentine endemics are the calcium and magnesium concentrations. Although these Iredell soils have a much higher calcium content compared to typical serpentine soils (7–10 mEq/100 g versus 0.2–4.0 mEq/100 g), the Iredell soils are also quite high in exchangeable magnesium relative to adjacent soils (5–7 mEq/100 g versus 0.1–0.3 mEq/100 g) (Dayton, 1966; Proctor and Woodell, 1975). There is evidence that some serpentine endemics require high absolute levels of magnesium (Proctor and Woodell, 1975). Thus, the diabasic glades, newly reported as habitats for *Aster depauperatus,* contain some but not all of the characteristics of serpentine barrens.

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